

- 1 1. A pressure-balanced battery for powering downhole drilling components in a subterranean
2 environment, the pressure-balanced battery comprising:
 - 3 a battery; and
 - 4 a housing enclosing and sealing a volume containing the battery, the housing being
5 expandable and contractible to balance pressure internal to the housing with pressure external
6 to the housing;
- 7
- 8 2. The pressure-balanced battery of claim 1, wherein the housing is in operable
9 communication with downhole fluids.
- 10
- 11 3. The pressure-balanced battery of claim 1, wherein the housing is integrated into the
12 annular structure of a downhole tool.
- 13
- 14 4. The pressure-balanced battery of claim 1, wherein at least a portion of the housing is at
15 least one of machined, milled, cast, and forged into a downhole tool.
- 16
- 17 5. The pressure-balanced battery of claim 1, wherein the battery comprises a plurality of
18 cells electrically connected in at least one of series, parallel, and a combination thereof,
19 within the housing.
- 20
- 21 6. The pressure-balanced battery of claim 1, further comprising at least one battery terminal,
22 connected to the battery, accessible through an opening in the housing.
- 23
- 24 7. The pressure-balanced battery of claim 1, wherein the battery comprises an electrolyte
25 selected from the group consisting of a fluid electrolyte and a solid electrolyte.
- 26
- 27 8. The pressure-balanced battery of claim 1, wherein the battery is a fuel cell.

1
2 9. The pressure-balanced battery of claim 1, wherein the battery further comprises a plurality
3 of components held together by a flexible casing, wherein the shape of the flexible casing is
4 selected from the group consisting of a substantially planar shape, a substantially cylindrical
5 shape, and a substantially semi-cylindrical shape.

6
7 10. The pressure-balanced battery of claim 1, wherein the battery is installed into at least one
8 recess formed in the wall of a downhole tool.

9
10 11. The pressure-balanced battery of claim 1, wherein the battery is in operable
11 communication with at least one of the group consisting of a downhole network, other
12 downhole tools, and transmission elements configured to transmit information between
13 downhole tools.

14
15 12. The pressure-balanced battery of claim 1, further comprising a signal-conditioning
16 module to modify characteristics of power output from the battery.

17
18 13. The pressure-balanced battery of claim 1, wherein the battery is rechargeable.

1 14. A pressure-balanced battery for powering downhole drilling components in a
2 subterranean environment, the pressure-balanced battery comprising:

3 a battery; and

4 a housing enclosing and sealing a volume containing the battery, the housing
5 comprising:

6 a substantially rigid portion;

7 a resilient portion deformable to vary the volume of the housing, the resilient
8 portion balancing pressure internal to the housing with ambient pressure external to
9 the housing.

10
11 15. The pressure-balanced battery of claim 14, wherein the resilient portion is in operable
12 communication with downhole fluids.

13
14 16. The pressure-balanced battery of claim 14, wherein the housing is integrated into the
15 annular structure of a downhole tool.

16
17 17. The pressure-balanced battery of claim 14, wherein the rigid portion is at least one of
18 machined, milled, cast, and forged into the structure of a downhole tool.

19
20 18. The pressure-balanced battery of claim 14, wherein the battery comprises a plurality of
21 cells electrically connected in at least one of series, parallel, and a combination thereof,
22 within the housing.

23
24 19. The pressure-balanced battery of claim 1, further comprising at least one battery
25 terminal, operably connected to the battery, accessible through an opening in the housing.

1 20. A method for providing power to downhole drilling components in a subterranean
2 environment, the method comprising:

3 providing a battery;

4 providing a sealed housing for the battery, the sealed housing having a resilient
5 portion flexible to vary the volume within the housing; and

6 flexing the resilient portion to balance pressure internal to the housing with pressure
7 external to the housing;

8
9 21. The method of claim 20, wherein flexing is actuated by communication between
10 downhole fluids and the resilient portion of the housing.

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27